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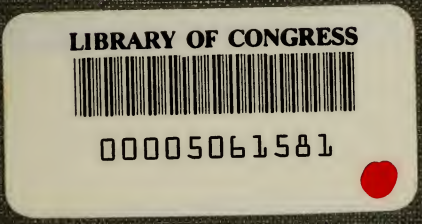


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THE

INDUSTRIAL CATECHISM,

TREATING OF

MANUFACTURES, AGRICULTURE,

THEIR PRODUCTS, MISCELLANEOUS PRODUCTS,

WEALTH, MINERALS, METALS,

AND

NATURAL PHILOSOPHY,

WITH MANY OTHER THINGS PROPER TO BE KNOWN.

FOR THE USE OF SCHOOLS.

PHILADELPHIA:
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PREFACE.

THE preparation of this small work for the young was undertaken from a belief that a work of the kind would be found both serviceable as a school book, and advantageous to parents, and others having the difficult and important duties of instructors to discharge. The outline and a proportion of the subjects were obtained from a work of London publication, which it was first contemplated to republish, with some trifling revisal, but on examination it was found, that, as a portion was inapplicable to the purpose, much to be discarded, and additional matter substituted, other parts were susceptible of amendment, while the whole needed arrangement. The work was therefore to be rewritten. In performance of this task it has been an endeavour to lay before the reader such subjects as are presented to the wondering minds of the young, at every step they advance in life. It has also been no less an aim to enforce upon their minds the paramount importance of industry and the industrial arts, to elevate labour and to inculcate a respect for the creators and producers—the bees in the social compact. Believing that industry is the true and only alchemy that can transmute the common materials of mother earth into the pure gold of plenty, peace and prosperity!

It will be found in many instances that questions are introduced where they have no essential connection with

the subject under discussion, in this the ordinary course of oral instruction has been pursued where incidental occasions often occur to inform upon a point, inculcate a lesson, or state a fact, which, if left unimproved, may be neglected or forgotten.

The statistics have been obtained from reliable authority, chiefly McCulloch and Taylor, and nothing has been stated without diligent enquiry and research.

A. H. M.

Philadelphia, August, 1849.

CATECHISM.

Manufacturing Products.

Q. What are manufactures?

A. All articles produced by labor, from raw, or other materials.

Q. What is their intent, and purpose?

A. To supply the necessities, the comforts and luxuries of life; comprising clothing, furniture, tools and utensils.

Q. Of what is clothing made?

A. It is made of wool, flax, hemp, cotton, silk, fur, leather, and of straw and grass. One or more of these materials, compose all the articles with which we clothe our bodies.

Q. What is wool?

A. The fleecy covering of the sheep, and is cut, yearly, from the animal while alive, which is called shearing.

Q. How many operations does wool pass through, in making it into cloth?

A. No less than twenty-six; ten before it is cloth, and sixteen in finishing.

Q. Where are woolen cloths chiefly manufactured?

A. In England, France, and Belgium, in Europe and in the United States, principally at Lowell, Massachusetts, in Rhode Island, in Connecticut and in Pennsylvania.

Q. Where is the wool chiefly grown?

A. The finest is grown in Saxony, but much is also produced in Spain and in England, in Australia and the United States.

Q. What is worsted?

A. It is hard twisted woolen thread, spun from the wool of a sheep that has been combed.

Q. What is cotton?

A. A soft downy substance, produced in pods on a tree that grows in warm climates.

Q. What size is the tree?

A. About the size of a currant bush. The pods or capsules are packed close with cotton, in which its small seeds are imbedded in the centre.

Q. How many kinds are there?

A. There are three. The nankeen, the green seed, and the black seed, or sea island. The black seed is the best, and has the longest fibres for spinning.

Q. Where is cotton chiefly grown?

A. In the southern portion of the United

States, namely, in the Carolinas, Georgia, Florida, Alabama, Louisiana, Arkansas, Mississippi, Tennessee, parts of Missouri and Kentucky, and in Texas. It is also grown in Egypt, Brazil and the East Indies.

Q. Are not great quantities of cotton used?

A. Yes. In 1848, there was grown in the United States, 1,066,000,000 of pounds, valued at $74,500,000. Great Britain imports above 300,000,000 pounds annually.

Q. Is more cotton manufactured than wool, flax, or silk?

A. Yes; 4 times as much as wool, 8 times the amount of flax for linen, and 50 times as silk.

Q. What is flax?

A. The stalks of the flax plant, the fibres of which are separated into thin threads, by softening in water and beating them, they are then dried and combed, to separate the coarser parts from the finer. The flax seed used as medicine is the seed of this plant, and is called linseed.

Q. What is hemp?

A. A production like flax, but obtained from a plant that grows larger and coarser, and in common with flax, much resembling the common nettle. Coarse linens are made

from it, as well as ropes, cables, twine and cordage.

Q. What is linen?

A. Cloth made from flax, or hemp; the flax is spun into threads and woven into cloth.

Q. Where is linen chiefly manufactured?

A. In the north of Ireland, in the Netherlands or Holland, and in Russia, where the flax is principally cultivated, the plant grows about 2 feet high and has a slender stalk.

Q. What is silk?

A. The web or cocoon of a peculiar caterpillar, commonly called the silk worm, which feeds on the leaves of the mulberry tree.

Q. What is the cocoon?

A. It is the shell or bed which the caterpillar spins and encloses itself in, when entering the chrysalis or torpid state, where it remains till its change to a butterfly.

Q. How are these cocoons made into silks?

A. The fibres after slight preparations are united, from four to fourteen together, and spun into thread and then wove into various elegant fabrics.

Q. Where are silk fabrics chiefly made?

A. At London, Macclesfield and Manchester in England, at Lyons, in France, and parts of Italy and India.

Q. What is leather ?

A. The skins of various animals, the hair of which is taken off, and tanned and otherwise dressed, to suit the various purposes.

Q. What is tanning ?

A. It is expelling the grease and making the skin more compact and tough, by the application of astringents. It is done by putting them in pits, with water and oak bark, broken up small, where remaining for some time, the hide is converted to leather.

Q. What is morocco leather ?

A. It is goat skin, dressed very soft and highly colored and glazed, and was first in use by the Moors in Morocco.

Q. What is parchment ?

A. It is sheep skin dressed in such manner as to approach as near as possible to the appearance of paper, for which it is substituted, for purposes where great durability is requisite: as the writing of deeds, wills and charters. It was invented at Pergamos.

Q. What is vellum ?

A. Vellum is a finer kind of parchment made of calf skin.

Q. Of what is furniture made ?

A. Principally of wood. Mahogany, rose wood, cherry, maple, oak and pine, with the

hair of animals for seats and mattresses, and feathers for beds.

Q. Of what are utensils made?

A. Of china ware, crockery and stone ware and glass, and of several metals, of iron, tin, copper and brass, and occasionally of gold and silver, and wood.

Q. What is china ware?

A. It is a beautiful article, white and semi-transparent, manufactured from a white clay and flint ground to powder. The art is originally from China, but is now in extensive use in France and England, it is called porcelain, from porcellanna, the name given to it by the Portuguese.

Q. What is crockery, or queensware?

A. It is an inferior or imitative kind of porcelain, possessing less of the vitrifiable, or glass making ingredient. flint, and thus much less transparent and delicate. The clay and flint is washed and purified, and kneaded into a stiff paste, it is then formed into various vessels, and dried and baked almost to melting, in a furnace.

Q. How is the glazing put on?

A. The vessels are taken out of the furnace and dipped into a mixture of water, pulverised flint and glass, and white lead,

this melts with the heat and forms a coating of glass.

Q. Where is it manufactured?

A. In Staffordshire, in England, at a district called the Potteries, and at Worcester; nearly the whole population being engaged in forming clay into vessels, from the commonest and cheapest to the most costly and elegant.

Q. What is glass?

A. Glass is a hard, and when pure, perfectly transparent substance obtained from that portion of earth's material called silex, of which flint is its general and most pure form. Flint when in thin pieces is slightly transparent, and when melted and purified by the chemical action of alkaline salts and metallic oxides, is glass.

Q. Describe its manufacture more particularly?

A. The ingredients to form glass generally used, are sea sand, which is flint in small particles, potash and red lead, the sand is the vitrifiable ingredient or that which forms the glass, the potash is the flux enabling the sand to melt, and the red lead gives greater solidity, greater power of refracting light, greater lustre, greater ductility and less liability to break from sudden heat or cold.

Q. How is it formed into the various articles in common use?

A. When in a melted state it is blown at the end of a tube, as children blow bladders from soap and water, and while soft moulded into bottles or glasses at will.

Q. Of what are tools made?

A. Principally of iron and steel.

Q. Of what and how is iron manufactured?

A. It is dug from the earth as coarse iron stone, and smelted in vast furnaces called blast furnaces, it is then cast into lumps which are called pig iron, or wrought into bars and then called bar iron.

Q. What is steel?

A. It is iron refined and hardened by a process called cementation which was first practised at Sheffield, in England.

Q. What is that process?

A. Bars of iron are placed in a box of iron with layers of charcoal powder between them, the box is then closed and put in a furnace with a number of flues to it, and subjected to a powerful heat for eight or nine days, it is then gradually cooled and becomes steel. This is called blistered steel and is composed of 99 parts iron, and 1 part carbon.

Q. Where and in what amount is iron produced?

A. In 1845, there was produced throughout the world near 4,500,000 tons; of this

Great Britain produced	-	2,200,000 tons,
United States	" - -	502,000 "
France	" -	448,000 "
Russia	" - -	400,000 "
Prussia	" -	300,000 "

the remaining 650,000 tons in the other parts of Europe?

Q. Is not the production of iron much dependent on coal.

A. Yes for it takes three and a half tons of coal to smelt one ton of iron, and twenty tons to make one ton of steel.

Q. What is coal?

A. A mineral fuel, consisting of carbon more or less impure, the purest is anthracite, which consists of more than 90 per cent of carbon, it is obtained by mining.

Q. Is coal produced in proportionate quantities to iron?

A. Nearly so. In 1845, Great Britain, Belgium, the United States, France and Prussia, produced 48,500,000 tons; of this was produced by

Great Britain,	- -	31,500,000 tons,
Belgium,	- - -	4,900,000 "

United States, - - 4,500,000 tons,
France, - - - 4,100,000 "
Prussia, - - 3,500,000 "

Q. What is the estimated value of coal produced annually by these five countries?

A. £30,000,000 sterling, or $145,200,000, which is six times the amount of gold and silver produced in North and South America, and Russia.

Q. Is a country possessing coal, then, richer than one possessing gold and silver?

A. Yes, both morally and physically: physically, by the products obtained through its agency, and morally, by the habits of industry induced thereby. The annual produce of the British coal mines is estimated at $96,000,000, and of iron produced through its agency, $40,000,000 at the furnace, or in the rough state, and from a portion of that, $82,000,000 of manufactured articles, of iron and steel.

Q. What effect has the production of coal on manufactures in general?

A. It is the foundation and principal source of all manufacturing and commercial prosperity, and the most essential agent of all industry.—McCulloch.

Q. How is it so?

A. Coal produces iron and steel and steam, of them, and by them, are manufactured tools and machinery, by the agency of these the infinite number of fabrics in use by man are wrought. Iron and steam are also the agents in dispersing these fabrics and thus are at once the producers and the vehicles of production.

Q. Then is Great Britain indebted to her coal for her manufacturing pre-eminence?

A. Yes, mainly so, for that led to her production of iron and invention of the steam engine, and thence to tools, machinery and manufactures in general.

Q. What is the condition of the United States as regards these elements of wealth and power?

A. The United States possesses more than thirty times as much coal and iron as Great Britain, and more than twelve times as much as all Europe. Pennsylvania alone has 14,500 square miles of coal lands, and Great Britain but 11,800.

Q. To what extent has the production of coal and iron increased in Pennsylvania?

A. In 1820 there was but 365 tons of anthracite coal produced throughout the state, in 1847 there was 2,982,000, and of iron was manufactured in 1828, 30,000 tons, and in 1846, 370,000.

Q. What amount of power is it thought is obtained from steam?

A. It is estimated that steam furnishes to man, a force equal to 10,000,000 of horses, or 60,000,000 of men.

Agricultural Products.

Q. What is agriculture?

A. The cultivation of the land in such manner as to make it yield more abundantly than it would without such cultivation.

Q. What are they called and in what estimation should their employment be held, who are engaged in it?

A. They are called farmers, and their employment shoud be deemed the most ancient, honorable and important of all labour, as it is as ancient as Adam, as honorable as the command of God can make it, and its importance can be only estimated by life itself.

Q. In what does their labour principally consist?

A. In manuring, ploughing, sowing, harrowing, reaping, harvesting, threshing, &c.

Q. What are the chief articles of their production?

A. All kinds of corn, pulse and esculent roots for man, and grasses for cattle.

Q. What is corn?

A. Any kind of grain or bread stuff, including wheat, rye, oats, barley, rice, and

maize, or indian corn, but applied exclusively to the latter in the United States.

Q. What are we to understand by corn as used in the scriptures?

A. Wheat is generally intended where we read "corn," but never indian corn or maize, as that was not known till after the time of Columbus.*

Q. What is pulse?

A. Peas and beans and other seeds that grow in pods.

Q. What are esculent roots?

A. Any root that is good for food, as potatoes, turnips, carrots and beets.

Q. What is horticulture?

A. The cultivation of orchards or fruit trees, as apples, pears, peaches and plums.

Q. What is floriculture?

A. The cultivation of flowering shrubs for the sake of the blossoms; grounds devoted to that purpose, are called nurseries.

Q. What do animals in general live upon?

A. Some on grass and seeds, as horses and

* (*Should any exception be taken to this humble attempt to correct a contracted, not to say misapplication of an iinportant term, it may be urged that where a word is used in a sense at variance with, if not in utter defiance of acknowledged standards, there can be no valid objection raised to the correction of such error, especially where it becomes no less necessary to a true reading of the scriptures than essential to a perfect understanding of the noble literature of our language.*)

cattle, these are called graminivorous, (from *gramen*, grass,) others on herbs, fruit, and the tender branches of trees, these are called herbivorous, and some on the flesh of other animals on which they prey, and are called carnivorous, (from *caro*, flesh, and *voro*, to devour.)

Q. What does man live upon?

A. Upon bread made of flour, upon the flesh of animals, upon the fruits of trees, and the leaves and roots of vegetables.

Q. What is flour?

A. Grain, generally wheat, ground to the finest powder and carefully sifted.

Q. What is the manner of making flour?

A. It is made in mills, generally worked by water power, consisting, with other machinery, of two circular stones, like large grind stones, laying on their sides one on the other, the under or nether mill stone being a fixture, the upper works round upon it, the wheat descends through the centre and is crushed between them, the flour then escapes by grooves cut from the centre to the edge of the stones.

Q. What other process does it pass through?

A. It is sifted through fine cloth which separates the husk or bran from the flour,

this is called bolting, it is then put in barrels and is fit for use.

Q. What proportion of flour does it take to make good bread?

A. It takes fifteen pounds of flour to make twenty pounds of bread.

Q. What is the weight of a barrel of flour?

A. One hundred weight and three quarters, or one hundred and ninety-six pounds.

Q. What is an hundred weight?

A. One hundred and twelve pounds.

Q. Why is that number adopted?

A. Because it is capable of being divided to a lower number than any other, the perfect hundred is divisable no lower than by 4, 25, 104 by 8, 13, while 112 can be divided by 16, 7, it is therefore adopted for its convenience.

Q. What is rice?

A. A grain, the wheat of the East Indies, it is grown in most warm climates and very extensively in the southern parts of the United States, it is cultivated in marshy lands partially under water, and forms the principal article of food for all the nations of Eastern Asia.

Q. What is sugar?

A. It is the principle of sweetness called saccharine, of which nearly all plants con-

tain a portion, but abounding most in the sugar cane.

Q. What is the sugar cane?

A. A plant of the rush species, growing to the height of from five to ten feet, it is cultivated in the East and West Indies, in the southern portion of the United States and in part of South America.

Q. How is sugar obtained from the cane?

A. When the canes are ripe they are cut down and placed in a mill and crushed with heavy wooden rollers covered with steel, the juice being obtained, it is boiled till it bebecomes thick, which, when dried, becomes brown sugar.

Q. What is white or loaf sugar?

A. It is sugar from which all the molasses and impurities have been removed by a series of processes of boiling, filtering, draining and crystalizing, which then becomes pure sugar.

Q. What is molasses?

A. That part of the juice of the sugar cane which will not crystalize, or which boiling will not bring to a consistence more solid than syrup.

Q. What is honey?

A. It is the sugar of various plants extract-

ed from their blossoms by the bees, and stored by them for their winter food.

Q. What is chocolate?

A. A beverage prepared from a paste made from the cacao nut and sugar.

Q. What is the cacao nut?

A. A nut growing in the West Indies, it is about the size of an almond and is produced from eighty to one hundred in a pod, the nut simply crushed will make an excellent beverage and is called cacao.

Q. What is coffee?

A. The berry of a shrub, a native of Arabia, where the Mocha coffee (a port on the Red Sea,) comes from, it is now most extensively cultivated in the West Indies and in Java.

Q. What is the character of the plant?

A. It is an evergreen, with leaves resembling the laurel and its blossoms white like the jessamine, the berry is at first a bright scarlet but changes to a dull red, and after being picked and dried, it becomes a dirty white.

Q. What is tea?

A. The leaves of a plant grown exclusively in China, it is an evergreen, the leaves are long and narrow with jagged edges, and the blossom resembles the dog rose.

Q. How are they prepared for use?

A. They are gathered one by one and are rolled up over hot plates and fanned while drying to make them crisp, they are then packed in boxes or chests lined with lead to preserve the purity of their flavour.

Q. What is black pepper?

A. The fruit of a climbing shrub, cultivated round poles like hops, it grows in the East and West Indies and bears white blossoms which produce bunches of red berries like currants, after drying by the sun they turn black.

Q. What is mustard?

A. A plant that grows to a considerable size, when compared with the smallness of its seed, which is no larger than a pin's head, and for this reason, selected by Christ for a parable, the blossom is yellow and the seed is ground to yellow flour which is the mustard used at table.

Q. What is ginger?

A. The root of an aromatic plant grown chiefly in the West Indies, resembling the flag in form and size, it is much valued as a spice and a medicine.

Q. What is cinnamon?

A. It is the inner bark of an aromatic tree

of the same name, growing in the East Indies and is a valuable spice.

Q. What are cloves?

A. Aromatic fruit of a large tree whose leaves resemble the laurel, the fruit is green at first but ripens brown, it is brought from Ceylon and other parts of India.

Miscellaneous Products.

Q. What is indian rubber or caoutchouc?

A. The dried or concrete juice of a tree that grows in South America and the East Indies, it is obtained from the tree by making an incision in the bark whence the juice issues and hardens on exposure to the air, it is sometimes but erroneously called a gum.

Q. What is gutta percha?

A. It is a similar production to caoutchouc and obtained in the same manner from a tree that grows in abundance on the Island of Singapore. It was first discovered in 1842, by Dr. W. Montgomerie, it is a Malay name, gutta, meaning the juice, and percha, the tree from which it is obtained.

Q. What are its peculiar qualities?

A. In thin slices it is semi-transparent and excessively tough, having much the appearance of horn, at ordinary temperature it is non-elastic and as hard as wood, by putting it in hot water it becomes exceedingly ductile and may be kneaded or pressed to any shape, which it retains upon cooling, without contraction and acquiring its original hardness.

Q. In what other respect does it differ from caoutchouc?

A. It is unlike indian rubber, by being insoluble in linseed or any of the fixed oils and scarcely at all affected by any unctious substance, this property renders it very valuable for driving bands for machinery, where it is constantly brought it contact with oils and grease.

Q. What is indigo?

A. A vivid blue dye procured from a shrub growing in the East Indies, it is obtained by cutting the plants down and placing them in water in a large vessel, as the plant decays a sediment is formed, and this dried is indigo.

Q. What is cochineal?

A. It is a small insect or fly found chiefly in Mexico, they are merely dried and when fit for use look like large grains of black tea, they make the most beautiful scarlet dye, and it is with this that the red moroccos and turkey reds are dyed.

Q. What is logwood?

A. It is a dye wood, the tree grows in the West Indies and obtains a great height, the colour is extracted by water and produces a deep red or purple, it is used as a basis for copperas in dying black.

Q. What is turpentine?

A. The resenous juice of the long leaved pine tree growing in North Carolina and some other of the southern States, it is obtained by making incisions in the tree and placing vessels to receive the juice, the same tree produces resin, tar and pitch.

Q. What is sponge?

A. A soft marine substance believed to be animal, found sticking to rocks or shells, it is obtained on the coast of Barbary and other parts of the Mediteranean.

Q. What is mother of pearl?

A. The inside coating of shells used for inlaying and ornamenting handles.

Q. What is ivory?

A. The tusks of the elephant which he sheds once, they are brought from Africa, and from the Island of Ceylon and other parts of the East Indies, and sometimes weigh two hundred pounds.

Q. What is tortoise shell?

A. The horny covering of the tortoise, it is principally obtained from a large species called the indian tortoise, measuring sometimes four feet in length.

Q. How is it obtained?

A. The natives of the Eastern Islands suspend the animal while alive over a fire,

until the shell is loosened, it is then set at liberty without its coat.

Q. What is camphor?

A. A white shining gum with a powerful scent, it is procured from a tree that grows in the Islands of the East Indies.

Q. What is whalebone?

A. A gristly bone extracted from the mouth of the whale, remarkable for its elasticity.

Q. What is isinglass?

A. A transparent gelatinous substance prepared from the membranes of a large fish like a sturgeon.

Q. What is salt?

A. A saline mineral, one of the great necessities of man, and with which Providence has plentifully supplied him.

Q. How is it obtained?

A. It exists as vast rocks in the earth and is obtained by mining, or from springs called brine springs, passing through such rocks and obtained by evaporating the water from the salt. It is also obtained the same way from sea water.

Q. What is starch?

A. A sort of paste made from wheat flour or potatoes, the flour is steeped in water,

which forming a sediment, is then dried and becomes starch.

Q. What is soap?

A. A compound of grease and alkali, the alkali being the cleansing ingredient and the grease serving to soften or weaken its effects.

Q. What are alkalies?

A. The fixed salt of plants or any vegetable substance obtained from their ashes. Potash is obtained from forest trees and soda from marine plants.

Q. How is potash obtained?

A. Hard woods are burned to ashes from which the salt is extracted by water, and the water is then evaporated by boiling in pots. Pearl ash is purified potash.

Q. What is charcoal?

A. Wood burnt until it has neither smell nor taste, and called by chemists carbon, it is united with nitre and sulphur in forming gunpowder.

Q. What is cork?

A. The bark of a tree of the oak species, chiefly grown in Spain, Italy, and the south of France.

Q. How is it obtained?

A. It is stripped from the tree in pieces about four feet by two, it is then laid in a pond or ditch and pressed with heavy

weights to flatten it. Before cutting up it is placed on a kind of gridiron and a fire made under it and burnt on both sides to harden it.

Q. What is paper?

A. It is one of the great inventions of man, being a most important agent in dispensing knowledge, it is made from linen and cotton rags and derives its name from papyrus, an Egyptian plant of which the ancients made leaves to write on.

Q. How is it manufactured?

A. The rags are put into a vat or trough with water, in which a wheel with long iron spikes are made to revolve, this tears the rags to pieces reducing them to a fine pulp.

Q. How is this pulp converted into sheets of paper?

A. A sufficient quantity of the pulp is taken up in a square mould with a wire gauze bottom like a seive, and the water being drained off it is turned out on to felt or woollen cloth and pressed and dried, this makes a single sheet, but it is also made in great lengths and wound round a series of rollers and cut into sheets when dry.

Q. Of what is paste board made?

A. It is made of old junk, that is, the old rope and rope yarn from the rigging of

ships, it is made similar to paper and when dry glazed and pressed very hard ; there is an inferior kind made of straw.

Of Wealth.

Q. What is wealth?

A. Wealth is the accumulation of the products of nature, and of labor bestowed on necessary or useful purposes.

Q. What are those products?

A. All things that are or may be used, to supply the necessities or the comforts or the luxuries of life.

Q. What are most important of those products?

A. Provisions, clothes, houses, utensils and furniture, the comforts principally consist in the abundance and quality of these things, the luxuries consist in the elegancies and refinement known to modern civilization.

Q. Then is wealth the direct consequence of industry?

A. It is the inevitable law of nature as regards nations and communities, and generally so as regards individuals.

Q. How is this fact proved?

A. By the evidence of history, showing us nations with a luxuriant soil and climate, and having had the treasures of the Indies laid at their feet, yet becoming poor because

unaccompanied by industry, while others with a less fertile soil, having industry only, have become rich and powerful and the controllers of the wealth of the world.

Q. What is currency?

A. It is the medium of exchanging one man's possessions for the possessions of another and is called money?

Q. What is the nature of its operation?

A. A man receives it in exchange for the product of his labor, and by it obtains the products of others, and this being acquiesced in by all, it becomes the current standard of value.

Q. How many kinds are there?

A. Two, metallic and paper.

Q. In what respect do they differ?

A. They are both alike but the representatives of wealth, but gold and silver has the advantage of being imperishable, and from their limited quantities, of a fixed determinate value, while paper is easily destroyed and may have any conceivable value put upon it.

Q. What advantages has paper over metal as a mediun of exchange.

A. Paper can be transported from place to place with much greater facility, and as an equivalent or means of adjusting claims, is adopted to all the various modes in which payments are made.

Of Minerals.

Q. How many kinds of minerals are there?

A. All minerals (that is, all earths, soils, stones, and ores or metals,) are divided into four classes:

1. *Earthy* minerals, as soil, &c.
2. *Saline* minerals, as salt, &c.
3. *Inflammable* minerals, as sulphur, &c.
4. *Metallic* minerals, as ores, &c.

Q. What is now known of earth?

A. It is found that there are not less than ten earths, quite different in their kind.

Q. Which are the most common and important?

A. The first is *silex*, which forms one half the ground on which we walk, and it is the hard and glassy substance of sands and rocks.

Q. What is the next earth in importance after silex?

A. *Lime*, the earth which forms limestone, marble, chalk, gypsum, shells, and bones of animals.

Q. What is the third earth in natural importance?

A. *Alumine*, and it forms all clays and soft earths, called *argillaceous*.

Q. What are the other distinct earths?

A. There are *seven* others, known to chemists as mixing with the others, and forming various substances.

Q. What are the other seven called?

A. Magnesia, barytes, strontites, zincon, glucine, yttria, and thorina.

Q. Are earths found separate?

A. Very seldom; but mingled together, they form all bodies, however various, which are called earthy or mineral.

Q. Then there is no single element of earth?

A. None; but that which is commonly called earth is a mixture of two, three, or more kinds, in various proportions.

Q. What is stone?

A. Generally sediments or settlements of earthy substances once dissolved in water, and re-formed into stony strata by long pressure.

Q. What are the small round stones or pebbles found in gravel, and scattered everywhere?

A. The parts of ancient rocks broken up by the sea, and worn round and smooth by the friction of tides.

Q. What is slate?

A. A blue rock, which is very soft when dug out of the quarry, and when hardened by exposure to the atmosphere it is split into thin squares. It is much used for the roofing of houses in Europe.

Q. What are metals?

A. They are hard compact bodies, found as ores in mines under ground. The ores, which consist of the metal and other substances, are prepared by burning, so that the chief metal is then obtained in a pure state.

Q. What is the quality of *malleability?*

A. Malleability implies the being beaten by a hammer and put into shape without breaking in pieces; it is opposed to brittleness.

Q. What do we mean by calling a metal *ductile*?

A. Ductile signifies flexible, pliable. When a metal can be drawn out into wire, it is called ductile.

Q. What is gold?

A. It is one of the precious metals, so called from being the universal standard of value. It is the most beautiful, scarce and imperishable of all the metals; it is alike un-

changed and unaffected by any exposure to the atmosphere, in common fire, or by the action of the most powerful acids, except oxygenated muriatic acid, which dissolves it.

Q. What other remarkable qualities does it possess?

A. It is so extremely malleable and ductile, that one grain, or the four-hundred and eightieth part of an ounce, can be made to cover 50 square inches, by beating it into leaf, or the same quantity made into wire, (that is silver with a gold surface, and of which gold lace is made) can be extended to the length of 345 feet, 6 inches.

Q. Where is it found?

A. It has been mostly found in the warmer climates, as Mexico, Brazil and Peru, the East Indies, and in Africa. It has also been found in the Carolinas and Georgia, and more recently in California, where it is generally found among the sand and mud of rivers and beds of former water courses, in the pure state, and in the shape of small flat pebbles.

Q. What is silver?

A. The other precious metal, much less scarce than gold and possessing some of the qualities of gold, in a less degree. It is found

in numerous parts of the world, mostly admixed with other ores and minerals.

Q. What is mercury, or quicksilver?

A. A metal, which in its natural state, is fluid, like liquid silver. It is so extremely subtile and volatile, as to render it difficult to hold or confine, and to entirely evaporate, at a heat a little above boiling water. It is obtained from mines in Spain, Italy and Hungary, sometimes pure, but mostly combined with other minerals.

Q. What is its use?

A. It is used to refine gold and silver, with which it readily combines, attracting and separating the metals from their impurities. It is also used for silvering mirrors. The glass is laid on a level table and tin foil spread over it; the coating of mercury is then put on and the whole pressed with heavy weights, the mercury combines with the tin and remains adhering to the glass.

Q. What is tin?

A. A metal principally obtained in Cornwall, in England, and Malacca, in the East Indies. It is very soft and malleable.

Q. What is it principally used for?

A. As a coating to iron and copper. Tin-plate is sheet iron dipped in tin, with which it becomes perfectly coated: the various

utensils called tin, are made of this plate. It is also much used as foil.

Q. What is copper?

A. A ductile metal, valuable for its toughness and comparative freedom from corrosion or rust in water, and for these reasons, much used in ship building: the planks being fastened withcopper nails and the bottoms sheathed with sheet copper.

Q. What is brass?

A. A compound metal of copper and zinc, which, rendering it much harder, makes it more adapted to many purposes, than copper.

Q. What is lead?

A. It is the softest and most easily melted of all the metals: it is used for water pipes and for the roofs and gutters of houses and is found in numerous parts of the world.

Q. What is loadstone?

A. An ore of iron, which, suspended from a point, always points to the north; from this peculiar quality, it is invaluable in forming the mariner's compass.

Of Specific Gravities.

Q. What is the weight or density of the several metals, as compared with water?

A. Taking water as 1, gold is $19\frac{1}{4}$: that is, $19\frac{1}{4}$ times heavier than water, mercury is $13\frac{1}{2}$, lead is $11\frac{1}{3}$, silver $10\frac{1}{2}$, copper $8\frac{3}{4}$, iron near $7\frac{1}{4}$, and tin a trifle over $7\frac{1}{4}$.

Q. Which is the lightest of all wood?

A. Cork is the lightest of woody matter, and is 4 times lighter than water.

Q. What is the heaviest and lightest of all liquids?

A. Mercury is $13\frac{1}{2}$ times heavier than water, and ether is only three quarters of the weight of water.

Q. How much heavier is water than air?

A. Water is 830 times heavier than air.

Q. What is the lightest of all known bodies?

A. Hydrogen gas, which is above 14 times lighter than air, and 12,000 times lighter than water.

Q. How many quarts of hydrogen gas would it require to weigh as much as one quart of water?

A. 12,000 quarts.

Q. How many quarts of air to make the weight of one quart of water?

A. 830 quarts.

Phenomena of Clouds, Rain, Etc.

Q. What are clouds ?

A. They are steam, fogs, or vapours of water, raised from the seas, lakes, and rivers by natural heat, called evaporation.

Q. What is evaporation ?

A. Heat, whether proceeding from the sun or a fire, causes the lighter particles of water to fly off, or evaporate in the air. The vapour thus produced, on rising into the colder regions of the air, is condensed into clouds.

Q. Have not the clouds regular forms.

A. Yes. There are large round masses of clouds, called *cumulus* clouds; straight flat clouds, called *stratus* clouds; and feathery clouds, called *cirro-stratus*, or *cirro-cumulus*.

Q. Are there not rain clouds?

A. Yes; and they are called *nimbus* clouds. A *nimbus* is when a straight or stratus cloud passes into a round *cumulus* cloud: this then falls in rain.

Q. What causes hail?

A. When the drops are formed and pass through a colder part of the atmosphere, they freeze and fall as hail.

Q. What makes it snow?

A. Such a degree of cold as freezes the vapour of the cloud before it has formed itself into drops.

Q. What becomes of all the rain that falls from the condensed clouds?

A. Part of it penetrates the ground and renders it fertile; part sinks to clay strata, and rises as springs; and part runs to the lowest ground, and forms brooks and then rivers, which flow to the sea.

Q. Why is rain water fresh, since it rises from the salt sea.

A. Because the heat, which evaporates water, does not evaporate salt, so that the vapour from salt water is fresh.

Q. What quantity of rain falls in a year from the clouds?

A. As much as would be equal to 20 or 30 inches in depth, in temperate climates, and from 80 to 200 in hotter climates.

Q. How high are the clouds?

A. Some are 6 or 7 miles high, others about a mile; some touch the tops of the hills, and others, as fogs, touch the level ground.

Q. What is a rainbow?

A. It is an apparent arch, of various colours, seen in the sky when the sun shines during rain. It is always opposite to the sun, being caused by the reflection of the sun's rays on and in drops of rain.

Q. What is dew?

A. It is condensed water from the atmosphere, by the coldness of plants and other matter on the surface of the earth. Water is taken up through the heat of the day, by evaporation, and the earth obtains it back again, by imparting sufficient coldness for its condensation at night.

Q. Can you give an illustration of it?

A. Yes. By putting a piece of ice or iced water in a tumbler, water will soon be seen to form on the outside of the glass; this is often called sweating, but it is the condensation of the watery parts of the air, by the coldness of the glass imparted by the ice; as by the grass at night, the same thing takes place on window panes, when the outside air is much colder than the inside.

Of the Elements, Senses, and Colours.

Q. What are the elements?

A. They used to be called *four*; earth, air, fire, and water; but they are now found to be far more numerous.

Q. What are the five natural senses?

A. Seeing, hearing, smelling, feeling and tasting. The *eye* is the organ of seeing, the *ear* of hearing, the *nose* of smelling, the *palate* of tasting, and *feeling* is a sense spread over the whole body, but particularly exercised in the fingers.

Q. What are the seven primary colours?

A. Grimaldi, an Italian Philosopher, discovered that a single ray or stream of light consists of seven different colours; namely, red, orange, yellow, green, blue, indigo, and violet; but late discoverers reduce them to red, yellow, and blue.

Of Heat.

Q. What is heat?

A. The great motion of the atoms of a body, so that when another body is brought into contact it suffers the same degree of motion in its atoms. It is called by chemists caloric.

Q. What is cold?

A. The absence of the degree of motion which causes heat. Every body is cold in whose particles there is less motion than in another body with which it is compared.

Q. Why do bodies feel hot to the hand?

A. Because their atoms, or small parts, are in greater motion than the atoms of the fingers or hand.

Q. Why do bodies feel cold to the hand?

A. Because their atoms are in less motion than the atoms which compose the hand.

Q. How do we know that heat is the motion of atoms?

A. Because we make our hands hot by striking them together, or on any surface, and make a nail hot by striking it with a hammer.

Q. What are atoms?

A. The smallest particles of which bodies are composed.

Q. What is meant by degrees of heat?

A. It has reference to the scale on the thermometer, an instrument to determine the amount of heat, by the expansion of mercury. A certain degree of heat is generally stated as so many degrees of Fahrenheit, the instrument having been invented by that Prussian Philosopher.

Q. What is the operation of the instrument?

A. It consists of a glass tube inserted in a hollow ball of glass. The ball is filled with mercury and also partly up the tube, the air being entirely excluded and the tube closed or sealed. As there is no room for the mercury to expand, but up the tube, its height there denotes the exact temperature to which it is exposed.

Q. What is the degree of the natural heat of the hand?

A. About ninety-eight degrees, the heat of boiling water being two-hundred and twelve degrees, and the freezing point being thirty-two degrees. Bodies therefore feel hot or cold, as above or below ninety-eight degrees, which is the heat of the hand.

Q. How is an animal body kept warm when the thermometer is at or below thirty-two degrees, the freezing point?

A. By breathing; the air inspired parting with its motion to the blood in the lungs, and warming the blood.

Q. Why does exercise warm us?

A. Because we breathe more in exercise than in sitting still, twice or thrice as much; and therefore in cold weather we jump about, to warm ourselves by quicker and harder breathing.

Q. Why do we wear clothes to keep us warm?

A. Because clothing, especially woollen garments, obstruct the escape of the heat from the skin.

Q. Is there no warmth in clothing?

A. None in the clothing itself. We generate or produce heat by breathing, and then more clothing obstructs the escape of the heat and returns it to our bodies.

Q. What is steam?

A. Steam is water evaporated with such rapidity as to become perceptible, and if confined, to produce a force.

Q. Can we convert the steam into water again?

A. Yes, by its coming in contact with the cold, it is condensed to drops of water again.

Q. What is ice?

A. It is water changed by the absence of heat, from its natural liquid state into a solid; and becomes liquid again by the application of heat.

Q. What is distillation?

A. The evaporating the spirituous parts of liquors by means of heat, and condensing them again into spirituous liquids.

Of Gases, &c.

Q. What is the motion supposed to exist in gases?

A. It cannot be exactly proved, but believed to be circular, or small orbits, created by projection and reaction.

Q. What are solids thought to be?

A. Fixed matter with small interstices of gas.

Q. What are liquids?

A. Atoms disunited and floating in gases.

Q. What are gases?

A. Fluids so excited, as that the vapours, by reaction in the space, become atoms in orbits in intense motion.

Q. How can we clearly understand all this?

A. By attending to the precise meaning of the terms used. We can understand anything if we know the exact meaning of the words employed.

Q. What is coal, or hydrogen, gas.

A. It is the same as that which makes flame in fire, and is now in general use, in cities, to lighten streets and houses.

Q. How is it made and conveyed through a city.

A. It is made at gas works; the fuel is put in large iron boxes called retorts, and exposed to the heat of a furnace; pipes convey the gas from these retorts to a large reservoir of water, through which it passes to purify it, and from thence, by pipes, throughout the city.

Q. What is smoke?

A. It is the steam of burning matter, expelled by lower degrees of heat, than would convert it into fire and flame.

Q. What is flame?

A. The union of the oxygen in the air, with the hydrogen which is excited and expelled from highly heated fuel.

Q. What is soot?

A. Soot is condensed smoke, which has been exhaled by the heat of the fire and not burnt.

Q. What is meant by a draft to a fire?

A. It is causing more air to pass to the excited hydrogen, and of course more of the oxygen in the air, and therefore producing more fire and flame.

Q. Does coal and wood and other combustibles contain hydrogen.

A. Yes, or they would not make fire and flame. The heat expels the hydrogen with force, and it then unites with the oxygen of the atmosphere.

Q. Then lighting a fire means exciting the hydrogen in the coal or wood.

A. Yes; and this hydrogen then unites with the oxygen in the air, and forms the vapour of water.

Q. What, is water formed by burning?

A. Yes; it is the forming of the water which causes the burning, for the hydrogen and oxygen gases, which filled a large space, are, as water, reduced to a very small bulk, and the motion in the gases is then distributed as heat.

Q. But what makes the light, and how is it distributed?

A. To make light there must be carbon, or fine charcoal, in the hydrogen; and hence the gas made in gas works is *carburetted hydrogen.*

Q. Then oxygen and hydrogen make the heat when they form steam of water, and the carbon in the hydrogen makes the fine white light or flame?

A. Yes, there would be no light without carbon; a little carbon makes a blue light, and a greater quantity a white light.

Q. Why does the burning continue after an applied light has been removed?

A. Because the oxygen and hydrogen in being fixed in watery particles part with sufficient motion to sustain the combustion.

Q. What are the results of burning ?

A. Steam of water by the union of the oxygen and hydrogen ;—white light and heat from the carbon heated and dispersed ;—and smoke or soot from the superfluous carbon.

Q. Then all burning produces four things ?

A. Yes ; water, light, heat, and smoke.

Q. What effect has it on the air ?

A. It abstracts the oxygen from the air ; and if in a close vessel, leaves only the nitrogen, and the burning then ceases.

Of Air.

Q What is the air which we breathe,—is not that a simple element?

A. No; it may be divided into two distinct elements, whose names and proportions ought to be remembered.

Q. What are the names of the two elements which compose air?

A. They are called oxygen, or vital air; and azote, or life destroying air; and the mixture of oxygen and azote forms the air which we breathe.

A. And in what proportion are they mixed in forming our air?

A. Nearly as one part of oxygen to four parts of azote.

Q. Is this proportion of one of oxygen to four of azote found to answer best?

A. It is then pure air, fit to support all animal life, and the burning of fires and candles.

Q. Then does life and fire depend on this mixture?

A. Yes, entirely so; if the air is taken away, no animal can live, nor any fire burn as it usually does.

Q. If the oxygen is removed, what then happens?

A. The animal dies and the fire goes out.

Q. And the best proportions are one part of oxygen and four of azote?

A. Yes; for if the oxygen is increased, health is impaired, and fires burn too fiercely; and if the azote is increased, death ensues, and fires are extinguished.

Q. Is not azote called by some other name?

A. Yes, it is often called *nitrogen.*

Q. Is the air entirely composed of these two gases, oxygen and nitrogen?

A. Not quite; it contains another gas called carbonic acid gas, and some vapour of water, but in small proportions.

Q. Is there not another gas very operative?

A. Yes; there is *hydrogen* gas, supposed to be derived from azote or nitrogen, and remarkable for its lightness, being fourteen times lighter than common air.

Q. How does hydrogen appear?

A. It appears in mines, where it explodes, and often kills the miners.

Q. How does carbonic acid gas appear?

A. In wells and other low places, where it sinks by its weight, and produces the *chokedamp*, which suffocates those exposed to it.

Of Fire.

Q. What is *fire*, another of the ancient elements?

A. A compound of hydrogen and oxygen, the union of which produces the heat, light, and flame.

Q. Where do they come from?

A. The hydrogen comes from the burning body, and the oxygen from the air. Air without oxygen gives no heat or flame, and a body which contains no hydrogen will not burn.

Q. What bodies contain hydrogen?

A. All woods, coals, vegetables, metals, spirits, &c.

Q. Then fire is an effect, not a substance or an element by itself?

A. Truly so. Fire is a mere effect of the union of two elements, oxygen and hydrogen gases.

Of Water.

Q. What is *water*, the other supposed element?

A. Water is a compound of hydrogen and oxygen gas, just as air is a compound of oxygen and azote.

Q. What proportions of hydrogen and oxygen gas form water?

A. Taken in bulk, or measure, water is one measure of oxygen to two of hydrogen; or, by weight, there are eight parts of oxygen to one of hydrogen.

Q. Why is this?

A. Because hydrogen is sixteen times lighter than oxygen.

Q. Then are we to discard the four elements of air, fire earth, and water?

A. Yes; because there are ten earths; because air is oxygen and azote; because fire is an effect of oxygen and hydrogen; and because water is a compound of oxygen and hydrogen.

Q. This appears very important.

A. Yes; it is the basis of much knowledge, and ought to be well remembered.

Of Gas.

Q. What is meant by gas?

A. Such a substance as air, which we feel by passing our hands quickly through it.

Q. Try it with your hand.

A. I feel a sort of wind.

Q. Then, is that oxygen and nitrogen?

A. Yes.

Q. We seem to live in it just as fish live in water?

A. Yes; and fish do not see the water in which they live, more than we see the air in which we live.

Q. How many gases are known?

A. Thirty or forty. Most solids and liquids can be converted into gas, vapour, or steam, by sufficient heat.

Q. Is it always done by heat?

A. No; it is often necessary to present other bodies to separate the gases.

Of Bodies.

Q. What are different kinds of bodies or substances?

A. All bodies are either solid, liquid, or gaseous, or partly one and partly the other.

Q. Can they be converted from one state to another?

A. Yes; by heat, solids can be rendered liquid, and liquids gaseous. And, by cold, gases can be made liquid, and liquids made solid.

Q. Give the example of water.

A. Heat converts solid ice into water, and more heat converts water into steam or aqueous gas. Then cold reconverts the steam into water, and more cold reconverts the water into ice.

Q. Then water has three states?

A. Yes; it is ice, or liquid, or gaseous, as the heat is increased; and it is gaseous, liquid, or ice, as the heat is decreased.

Q. In hot weather, why does not all water become steam?

A. Because it is pressed upon by the air with a force of fifteen lbs. to every square

inch of surface; but when this pressure is anyhow removed, water becomes steam?

Q. But as the pressure of fifteen lbs. to the square inch usually continues, how does water become steam?

A. By increasing the heat or motion to two-hundred and twelve degrees of the thermometer, when the motion of the atoms of water becomes greater than the pressure of the air, and the water boils or rises in steam.

Q. But will liquids boil at a lower degree of heat than two-hundred and twelve?

A. Yes; by expelling the air from the surface, and this is in actual practice in the modern process of sugar refining; the sugar being boiled at one-hundred and fifty degrees of the thermometer, in what is called vacuo, that is, the boiling vessel is enclosed in another from which the air is exhausted, steam being used to communicate the heat.

Of Atmospheric Pressure.

Q. What is this pressure of fifteen lbs. to the square inch called?

A. It is called atmospheric pressure, which is the weight of the atmosphere on the surface of the earth, being equal to a column of mercury, thirty inches in height, or thirty-four feet of water.

Q. How is this fact ascertained?

A. By taking a glass tube, of thirty-one inches, or more in length, with one end perfectly closed, then filling it with mercury and stopping the open end with the finger, turning it upside down and plunging it into a basin of the same liquid, when removing the finger, the mercury will remain balanced in the tube, to the height of thirty inches from the surface in the basin.

Q. What is this instrument called?

A. The barometer. It is used to denote the changes in the weather, by the fluctuations in the weight or density of the atmosphere, and also to measure the height of mountains, by the falling of the mercury, according to the elevation obtained.

Q. Is not this a very important discovery?

A. Yes; as it explains some very wonderful phenomena in nature, such as the principle of action of pumps and syringes, the walking of a fly on the ceiling, and the true nature of that which is called suction.

Q. Explain the action of a syringe.

A. By the drawing back of the piston or sucker as it is called, while the point is under water, a vacuum, or space containing no air would be created, but the water rushes in and fills the space forced by the weight of the atmosphere on its surface: the discharge is simply by compression.

Q. What is the action of the common pump, and what is it called?

A. It is called a lift pump, and consists of a pipe or tube in which a piston works as in a syringe, but having an opening or door in it, called a valve, opening upwards and admitting whatever would pass up, but closing on all that would pass down.

Q. What is the operation of this valve?

A. As the piston is lowered, the air in the pipe, between it and the top of the water, opens the valve and passes upwards; upon raising the piston, the valve closes, and the water follows the piston as in a syringe, to the amount of air that has been removed.

Q. But the water is only partially raised—how is it made to flow out at the top?

A. By successive strokes the whole pipe is exhausted of air, and filled with water instead; now, upon the descent of the piston, the water passes through the valve, and on its rising lifts the water, which then flows out at the first opening.

Q. Can water be raised to any height by this pump?

A. No. It can be raised only thirty-four feet, which is equal to the thirty inches of mercury in the barometer: thirty multiplied by thirteen and-a-half, the comparative weight of mercury to water, gives four hundred and five inches, which is thirty-three feet, nine inches, the exact height water can be raised by a lift pump.

Q. Was this fact known before the discovery of the weight of the atmosphere?

A. Yes; and it was this question which led Galileo and his pupil Toricelli, to the discovery and the invention of the barometer.

Q. What is the difference between a force pump and a lift pump?

A. In a force pump the piston has no opening, and is the same as in a syringe; but the valve opening upwards, is a fixture in the pipe below, between this and the piston, is

another valve, in the side, and opening outwards, permitting all to pass out but nothing to pass in.

Q. What is the purpose of this side valve?

A. By the first stroke of the piston the air is forced out at the side valve, and upon raising it, the valve closes, and is held shut by the air, with a force of fifteen lbs. to the square inch, the lower valve now opens, admitting the air from below, and its place is immediately supplied with water, as in the lift pump.

Q. How is the force obtained?

A. When the pump becomes filled with water by successive strokes, the descent of the piston then forces the water out at the side valve, and it is by the power of the piston being greater than the means of escape, that the water is compressed, and a force obtained, as in a common syringe: it is with this class of pump, that fire engines are furnished.

Conclusion.

Q. What are the subjects which good children ought to learn, to fit them for respected men and women?

A. Every good child should learn to read, and to understand what he reads; for books contain the wisdom of former ages, and are full of instruction and amusement.

Q. What is the use of writing?

A. To correspond with our parents, relations, and friends at a distance; to keep accounts of trade, receipts and expenditure, and to record our own opinions.

Q. What is the use of arithmetic?

A. It teaches us to count and express numbers, to calculate products and results, and is called into exercise in the whole business of life.

Q. What is the use of grammar?

A. It enables us to speak and write with correctness, and with due regard to the connexion of words with one another; for words vary as they have relation to other words.

Q. What is the use of Greek and Latin?

A. They are useful to finished scholars, as they illustrate many terms of science.

Q. Is Latin or Greek, as taught in schools, spoken anywhere?

A. Nowhere; they are not living languages, and are only to be met with in ancient books.

Q. Are French, or Italian, or German, or Spanish useful.

A. Yes; they are living languages, spoken by great nations, and abound in very interesting books on modern subjects.

Q. Is the knowledge of Geography necessary?

A. Highly so; and no one can read even a common newspaper with understanding, who is ignorant of geography and of the study of maps.

Q. Is history useful?

A. Yes; very useful, very instructive, and very amusing. We learn by it all that has happened in the world before our time; and, above all things, every youth should be versed in the history of his own country.

Q. Is the study of natural philosophy necessary?

A. Yes, to all who would pass through life with credit, and with the reputation of being

well informed. No pastime is so agreeable as experiments and speculations on nature, and on the causes of phenomena.

Q. Is biography useful?

A. No reading is more so. It is a mirror for our own example, and every well educated person should be familiar with the lives and actions of the great men of all ages.

Q. Are studies in mathematics necessary?

A. Generally so; and every young person, male and female, ought to be familiar with practical geometry; and every young man should amuse himself with the demonstrations in Euclid, and with problems in algebra.

Q. Is poetry useful?

A. Yes; so far as it embodies noble and useful sentiments, which excite to virtuous actions and public spirit. Milton, Young, Dryden, Pope, and Cowper can never be too often read.

Q. Is the art of drawing a desirable acquirement?

A. Yes, nothing more desirable; it teaches us to observe and examine all objects that we see; and it is an inexhaustible source of amusement to ourselves and gratification to our friends.

Q. What is the use of music?

A. It is the modifier of sound into melody and harmony, in accordance with our most refined perceptions; and is the most exquisite pleasure of the mind known to man. It is in its practice and perfection the most agreeable of all pastime.

Q. Is religion a subject for scholastic instruction?

A. None is more so. Every child ought to be exercised in questions on the Old and New Testament; and ought to be able to estimate the moral duties which are inculcated throughout the Sacred Writings.

Q. What ought an educated boy to be familiar with at fifteen?

A. He ought to read and write well, to be able to calculate in various rules decimally and to work simple equations in algebra; he should be familiar with English grammar and with some foreign language; be able to draw geometrically, and by hand; know geography, history, and biography; and be practised in book-keeping.

Q. What ought a well educated girl to have learnt at fifteen?

A. She ought to read freely in prose and verse; to write grammatically; to be expert in arithmetic; to be familiar in geography,

history, and biography; to be mistress of approved and desirable accomplishments; and, above all, to be ready at all kinds of needlework and housewifery.

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